

Applicant(s): Eitan Bachmat, Tao Kai Lam and Ruben Michel
Serial No.: 09/541,159
Filed: March 31, 2000

E30-043 (99-202)

REMARKS

This application is pending with claims 1 through 28. Claims 23 through 28 are allowed. Claims 1 through 6, 8 through 10 and 19 through 22 are rejected while claim 7 and 11 through 18 are objected to. Applicants are amending claims 1 and 9. Claims 1 through 28 remain in the application.

Applicants request reconsideration and reexamination of the above-identified application in view of the amendments made to the specification and claims. The following remarks state Applicants' bases for making this request and are organized according to the Examiner's Action by paragraph number.

Examiner's Action, Paragraph 1

The Examiner finds the remarks filed on July 14, 2003 as being not persuasive. Specifically, the Examiner argues that claim 1 does not claim the "actual seek time which is used to drive the disk head from a starting location to a destination".

The Examiner further argues that "segments such as zones and sectors are inherent data storage locations in a disk such as Satoh's."

Applicants have amended claims 1 and 9 to more clearly define the measurement of actual seek times for seek operations between arbitrary segments of contiguous tracks.

Applicants therefore respectfully submits that each of

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claims 1 and 9 define the measurement of the actual seek times that exist between the different combinations of segments of a physical disk drive. Given the context of the Satoh patent, Applicants respectfully request the Examiner to identify a source for the conclusion that "segments such as zones and sectors are inherent data storage locations in a disk such as Satoh's."

Examiner's Action, Paragraphs 2 and 3

The Examiner rejects claims 1 through 6 and 8 under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 5,696,646 (the Satoh patent) in view of U. S. Patent No. 5,313,617 (the Nakano patent). Specifically the Examiner argues that the Satoh patent discloses moving a disk head between first and second addresses, establishing an array of seek times for seek operations between each segment pair, referring to FIG. 7, and generating a seek time for disk head movement between the first and second addresses by interpolation. With respect to claim 3, the Examiner argues that the segment boundaries and first and second addresses are independent and that the seek time generation uses the first and second addresses as reference locations in each of the logical blocks. With respect to claim 5, the Examiner argues that the Satoh patent discloses generating a linear

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interpolation which, with respect to claim 6, is based upon a ratio analysis. With respect to claim 8 the Examiner argues that the physical disk drive in the Satoh patent includes a data block and the interpolation uses boundaries of the data block to obtain disk seek times or seek operations within the data block.

The Examiner does recognize that the Satoh patent does not disclose dividing the disk into a plurality of segments having a given size defined by first and second boundaries as stated in claim 1 or the division of the segments into segments of equal size as set forth in claim 2 or the use of a reference given relative to the predetermined position on the physical disk drive as set forth in claim 4. However, the Examiner argues that the Nakano patent teaches these features. Consequently the Examiner concludes that it would have been obvious to one of ordinary skill in the art at the time of the invention to divide the disk of the Satoh reference into several volumes each of equal size and reference addresses such as in the Nakano patent because information which is managed under one volume could be searched and addressed more effectively.

Applicant respectfully traverses this rejection.

As Applicants understands it, it is the intent of the Satoh patent to provide an indication of a potential error

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whenever the actual seek time between two addresses exceeds a predetermined maximum seek time. The Satoh patent calculates a maximum seek time for each seek and indicates that an error exists if the actual seek time exceeds that predetermined maximum. To obtain this information, the Satoh patent calculates the times for a minimum seek (e.g. a 1-cylinder seek) and for a maximum seek (e.g., 2000-cylinder seek). An additional increment of time is added. The result is a seek time formula:

$$T_s = (\alpha(CL_o - CL) + T_{\min}) + \beta$$

There is an erroneous assumption in this calculation. Specifically the assumption is that a seek of a given number of cylinders will take the same amount of time regardless of where the cylinders are selected. A fact that proves not to be a valid assumption. That is, a 10-cylinder seek at the outer periphery of a disk will be different from a 10-cylinder seek at the inner portion of a disk. See FIG. 5A of Applicants' specification, for example.

Claim 1 defines a method that provides a more accurate indication of seek times. First the physical disk is divided into segments. Each segment has a plurality of contiguous

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tracks. The segments are divided into segment pairs. If there are four segments and the seek times moving in the opposite directions are the same, there are six segment pairs. An actual measurement is made to determine the actual seek time between each of these segment pairs based upon the first and second boundaries of those segments. These actual seek times will take into account the very differences in seek times from one portion of a physical disk drive to another that the Satoh patent ignores. In accordance with claim 1, seek times for disk head movement are then interpolated based upon these actual seek times, but based upon the actual addresses.

Applicants see nothing in the Satoh patent or the Nakano patent that suggests the division of a physical disk drive into arbitrarily sized segments of a plurality of contiguous tracks and the establishment of an array of actual seek operations between each segment pair based upon the first and second boundaries. Applicants see nothing in the Satoh or Nakano patents that further discloses or suggests the generation of a seek time for disk head movement between the first and second addresses by interpolating the array of actual seek times based upon the first and second addresses.

Examiner's Action, Paragraph 4

The Examiner rejects claims 9, 10 and 19 through 22 based

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on some of the same arguments as presented with respect to claims 1 through 6 and 8. More specifically with respect to claim 9, the Examiner argues that the Satoh patent discloses (1) the determination of seek times, (2) the accumulation of statistics, (3) the conversion of accumulated statistics into an estimated number of seeks, (4) the definition of a seek time for each logical of a plurality of logical volume pairs and (5) the generation of a total seek time. With respect to claim 10 the Examiner argues that the Satoh patent shows the assignment of a predetermined seek time for each seek operation and the calculation of intra-seek time based upon predetermined seek times. With respect to claim 19, the Examiner argues that the Satoh patent discloses a determination of the time for a seek operation within a logical volume. With respect to claim 20, the Examiner argues that the Satoh patent discloses the determination of an intravolume seek time. With respect to claim 21, the Examiner argues that the Satoh patent discloses the definition of an intravolume seek time to include the interpolation of seek times and that in claim 22 the definition of seek time includes the step of linearly interpolating seek times.

The Examiner further argues that the Nakano patent discloses a disk configured to store data in a plurality of logical volumes and a division of a physical disk drive into

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fixed sized segments independently of logical volume configuration in the physical disk drive. Consequently the Examiner concludes that, with respect to claims 9, 10 and 19 through 22, there is a requirement that information storage medium should be partitioned into a plurality of logical volumes with fixed size segments so that addresses can be created accordingly for data allocation and that the combination of the disclosures in the Satoh and Nakano patents would provide sufficient information to allow a person of ordinary skill in the art to have made this invention.

Applicants respectfully traverse this rejection.

Before discussing the Examiner's rejection in detail, it will be helpful to review the configuration of a disk drive in accordance with this invention as set forth in claim 9. For purposes of seek analysis, a physical disk drive is divided into segments of contiguous tracks. The assignment of starting and ending addresses for each of these segments is completely arbitrary and has nothing to do with the configuration of a physical disk drive into multiple logical volumes. If a physical disk drive is partitioned into multiple logical volumes, there is no requirement that the extent of a logical volume coincide with any of the segments. That is, a logical volume could be completely contained within a segment along with portions of other logical volumes. A logical volume could

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have a starting address in one segment and an ending address in another segment. A logical volume could span multiple segments. Obviously it is also possible that the starting and ending address of a logical volume could coincide with the starting and ending addresses of a segment. What is important to remember is that the configuration of a physical disk drive into logical volumes and the assignment of starting and ending addresses for segments are completely arbitrary and independent of each other.

With respect to the specific rejection, Applicants again submit that the Satoh patent does not determine actual seek times for seek operations between segments. The Satoh patent produces values for Tmax dependent upon the number of cylinders traversed during a seek operation. This is an essentially linear relationship and is constant across this physical disk drive. Consequently a 10-track seek at cylinder 1000 is assigned the same value as 10-track seek at cylinder 1500 or cylinder 1900. In accordance with this invention it is normal for a seek time for a given number of tracks to differ for each pair of segments. See, for example, FIGS. 5A through 5C of the specification.

Applicants see nothing in the Satoh patent that corresponds to the accumulation of statistics for each access to each logical volume during a time interval. As Applicants

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understand it, the primary objective of the Satoh patent is to provide control for a seek operation in which an error monitoring section monitors seek operations and determines abnormal endings thereby to force changes of control without submitting an error report to a higher level controller. To accomplish this, each disk operation includes the step of determining the preassigned maximum seek time for the number of cylinders to be traversed in the seek, starting the seek and then determining if the seek operation is completed within that period of time.

Applicants see nothing in this application that indicates that statistics are accumulated over a time interval for multiple accesses to logical volumes. Applicants see nothing in the Satoh patent that defines a seek time for each logical volume pair that is based upon the actual segment seek times. In the Satoh patent the seek times are based upon the entire physical disk drive and Applicants see no indication that access is based upon logical volume pairs or actual segment seek times are involved in any of the calculations in the Satoh patent.

Applicants see nothing in the Satoh patent that discloses or suggests the generation of a total seek time for each logical volume pair over the time interval of the measurements.

Applicant sees nothing in the Satoh patent that relates to a

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calculation of a intra-segment seek time in view of the fact that the Satoh patent does not disclose segments.

With respect to claim 19, Applicants see nothing in the Satoh patent that discloses determining the time for a seek operation within a logical volume in accordance with the invention as set forth in claim 9. At most the process set forth in the Satoh patent might be used as a possible approach for providing an intra-volume seek time. However, if the Satoh patent is disclosing that feature, the Satoh patent does not disclose all the other requirements of claim 19 as set forth in parent claim 9.

Applicants further submit that the Satoh patent does not disclose or suggest the determination of intra-volume seek times in accordance with those claims by using the combination of logical volume boundaries and segment boundaries information.

Examiner's Action, Paragraph 5 through 7

Applicants appreciate the allowance of claims 23 through 28 and the indication that claims 7 and 11 through 18 would be allowable if rewritten in independent form including all the limitations of the base claim and intervening claims. As Applicants believe that independent claims 1 and 9 define an invention that is patentable over the prior art, Applicants

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have not rewritten claims 7 and 11 through 18 at this time.

Applicants also have reviewed the Examiner's statement of reasons for the indication of allowable subject matter. Applicants respectfully request the Examiner to modify that statement as may be appropriate if all the claims are allowed.

Examiner's Action, Paragraph 8

Applicants have reviewed the other prior made of record, but not relied upon. Applicants see nothing in any of these references taken singly or in combination with each other or with the Satoh and Nakano patents that discloses or suggests Applicants' invention.

Drawings

Applicants are forwarding new formal drawings in response to the Notice of Draftperson's Patent Drawing Review by mail on this date. A copy of the transmittal for these drawings is attached.

Summary

Applicants have amended claims 1 and 9 to more clearly define Applicants' invention. Applicants respectfully submit that each of claims 1 through 28 defines a novel method and that the differences between the method as recited in each

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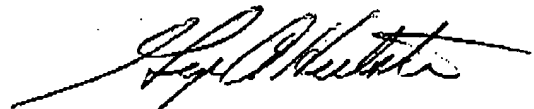
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claim and the prior art would not have been obvious to a person of ordinary skill in the art at the time Applicants made their invention. Therefore Applicants respectfully request the Examiner to reconsider the rejections and allow claims 1 through 28 as amended.

We respectfully request that this amendment be entered because we believe that it places the application in condition for allowance or in better condition for appeal.

If there are any questions, we urge the Examiner to call us collect.

Respectfully Submitted,



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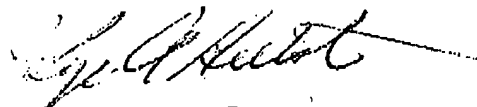
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A copy of the amended drawing is attached. The requested changes are annotated thereon in red ink. Applicant is submitting herewith formal drawings (8 sheets).

If there are any questions, we urge the Examiner to call us collect.

Respectfully Submitted,



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